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Date: 10-18-04

Himanshu S. Amin

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re patent application of:

Applicant(s):	Anwar Chitayat, *et al.*	Examiner:	Burton S. Mullins
Serial No:	09/817,622	Art Unit:	2834
Filing Date:	March 26, 2001		

Title: SYSTEM AND METHOD TO CONTROL A ROTARY-LINEAR ACTUATOR

Mail Stop Appeal Brief – Patents
Commissioner for Patents
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APPEAL BRIEF

Dear Sir:

Applicants' representative submits this brief in connection with an appeal of the above-identified patent application. A credit card payment form is filed concurrently herewith in connection with all fees due regarding this appeal brief. In the event any additional fees may be due and/or are not covered by the credit card, the Commissioner is authorized to charge such fees to Deposit Account No. 50-1063 [ALBRP140USB].

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I. Real Party in Interest (37 C.F.R. §41.37(c)(1)(i))

The real party in interest in the present appeal is Anorad Corporation, the assignee of the present application.

II. Related Appeals and Interferences (37 C.F.R. §41.37(c)(1)(ii))

Appellants, appellants' legal representative, and/or the assignee of the present application are not aware of any appeals or interferences which may be related to, will directly affect, or be directly affected by or have a bearing on the Board's decision in the pending appeal.

III. Status of Claims (37 C.F.R. §41.37(c)(1)(iii))

Claim 5 has been cancelled. Claims 1-4 and 6-27 stand rejected by the Examiner. The rejection of claims 1-4 and 6-27 is being appealed.

IV. Status of Amendments (37 C.F.R. §41.37(c)(1)(iv))

No claim amendments have been entered after the Final Office Action.

V. Summary of Claimed Subject Matter (37 C.F.R. §41.37(c)(1)(v))

A. Independent Claim 1

Independent relates to an integrated rotary-linear actuator system. The system includes a plunger movable along and rotatable about a longitudinal axis extending through the plunger, wherein the plunger is supported against a motor support via bearings; a coil system having two sets of coils arranged to, when energized, interact with the plunger, the first set of coils being operative to provide an electric field to effect movement of the plunger in a linear mode, the second set of coils being operative to effect movement of the plunger in a rotational mode; an amplifier coupled to the coils and operative to provide electrical energy to energize the coils; and a control system integrated with the amplifier, the control system having a network interface operative to receive control information, the control system being operative to control the amplifier to selectively energize the coils to effect desired movement of the plunger based on the

control information received via the network interface, wherein the control system and an associated rotary-linear motor are integrated into a single module. (*See e.g.*, page 2, lines 5-15).

B. Independent Claim 11

Independent claim 11 recites a rotary-linear actuator system, that includes a motor support having a well; a plunger supported for movement via bearings in at least part of the well so as to enable axial movement of the plunger relative to the well along a longitudinal axis of the plunger and rotational movement of the plunger about the longitudinal axis; an array of permanent magnets associated with the plunger, wherein half of the magnets are oriented such that their north poles point radially outward and the other half such that their north poles point radially inward; a first set of coils arranged to, when energized, apply an electric field that interacts with the array of magnets and provides an axial force to drive the plunger element in a linear mode; a second set of coils arranged to, when energized, apply an electric field that interacts with the array of magnets and provides a tangential force to drive the plunger element in a rotational mode; and an integrated control system having a network interface operative to receive control information via an associated network, the control system being operative to selectively energize the first and second sets of coils to effect movement of the plunger in at least one of the linear and rotational modes, wherein the integrated control system and an associated rotary-linear motor are integrated into a single module. (*See e.g.*, page 4, line 23-page 5, line 30 and page 10, line 27-page 13, line 11).

C. Independent Claim 16

Independent claim 16 relates to an integrated rotary-linear actuator system. The system includes means for supporting a plurality of motors including means for supporting a bearing, the means for supporting the plurality of motors and the means for supporting the bearing defining a well. (*See e.g.*, page 4, line 23-25). The system also includes means for moving a stage and adapted to be received by the well, the means for moving the stage being axially movable along its longitudinal axis between retracted and extended conditions and rotatable about its longitudinal axis, the means for moving the

stage being supported by a bearing located between the means for moving the stage and the means for supporting the bearing. (*See e.g.*, page 4, lines 28-29; page 7, line 30-page 8, line 11). The system further includes means for providing a magnetic field arranged on the means for moving the stage. (*See e.g.*, page 4, line 29-page 5, line 7). The system also includes means for applying a substantially axial force on the means for providing the magnetic field and driving the means for moving the stage linearly. (*See e.g.*, page 5, lines 8-10). In addition, the system includes means for applying a substantially tangential force on the means for providing the magnetic field for the means for moving the stage rotationally. (*See e.g.*, page 5, lines 10-12). Additionally, the system includes means for amplifying an electrical signal and providing the amplified signal to at least one of the means for applying. (*See e.g.*, page 5, lines 17-19; page 11, line 30-page 12, line 10). The system also includes control means for controlling the means for amplifying, the control means including means for interfacing with an associated network and receiving control information to program the control means to control the means for amplifying to selectively activate the means for applying, and transmitting diagnostic information to at least one computer associated with the network, wherein the control means and an associated motor are integrated into a single module. (*See e.g.*, page 5, lines 17-19; page 11, line 30-page 12, line 10).

The means for limitations described above are identified as limitations subject to the provisions of 35 U.S.C. §112 ¶6. The structures corresponding to these limitations are identified with reference to the specification and drawings in the above-noted parentheticals.

D. <u>Independent Claim 17</u>

Independent claim 17 recites a method for controlling an integrated rotary-linear actuator system. The rotary-linear actuator system includes a control system and an associated rotary-linear motor integrated into one module, the control system including a network interface to enable communication over an associated network, the method comprising: receiving control information at the network interface of the integrated rotary-linear actuator system *via* the associated network; programming operating parameters of the rotary-linear actuator system based on the received control information;

and controlling an amplifier to selectively energize two sets of coils of the rotary-linear actuator system according to the programmed operating parameters, such that a plunger, which is moveable linearly and rotationally about a longitudinal axis thereof, moves in at least one of a linear and rotational direction, the linear direction in response to the energization of a first set of coils, and the rotational direction in response to the energization of a second set of coils. (*See e.g.*, page 18, line 22-page 20, line 16).

E. Independent Claim 22

Independent claim 22 relates to an integrated rotary-linear actuator system. The system includes a plunger movable along and rotatable about a longitudinal axis extending through the plunger, wherein the plunger includes an inner and an outer cylindrical portion, both open at one end, with permanent magnets attached to the inner walls of the inner and outer cylindrical portions; air bearings supporting the plunger against an actuator support stage; a coil system having coils arranged to, when energized, interact with the magnets attached to the plunger to move the plunger in a rotational mode and/or a linear mode; an amplifier coupled to the coils to provide electric energy to the coils; a control system and a network interface integrated into a single module, the control system integrated with a rotary-linear actuator, the network interface receiving and transmitting at least one of control and diagnostic information to an associated network. (*See e.g.*, page 2, lines 5-23).

VI. Grounds of Rejection to be Reviewed (37 C.F.R. §41.37(c)(1)(vi))

A. Claims 1-2, 4, 7-10 and 17-21 are unpatentable under 35 U.S.C. §103(a) over Kemmer *et al.* (US 4,234,831) in view of Spinner *et al.* (US 5,771,174) and Mizutani (US 5,532,533).

B. Claims 11-15 are unpatentable under 35 U.S.C. §103(a) over Sudo *et al.* (US 4,644,205) in view of Spinner *et al.* (US 5,771,174) and Mizutani (US 5,532,533).

C. Claims 1-10 and 16-21 are unpatentable under 35 U.S.C. §103(a) over Sudo *et al.* (US 4,644,205) in view of Spinner *et al.* (US 5,771,174), Gerard (US 4,751,437) and Mizutani (US 5,532,533).

D. Claims 1-4, 7-10 and 16-21 are unpatentable under 35 U.S.C. §103(a) over Kemmer *et al.* (US 4,234,831) in view of Lee (US 4,692,678) and Mizutani (US 5,532,533).

E. Claims 11-15 are unpatentable under 35 U.S.C. §103(a) over Sudo *et al.* (US 4,644,205) in view of Lee (US 4,692,678) and Mizutani (US 5,532,533).

F. Claims 22-27 are unpatentable under 35 U.S.C. §103(a) over Sudo *et al.* (US 4,644,205) in view of Horikoshi *et al.* (US 5,142,172), Gerard (US 4,751,437) and Spinner *et al.* (US 5,771,174).

VII. Argument (37 C.F.R. §41.37(c)(1)(vii))

A. Rejection of Claims 1-2, 4, 7-10 and 17-21 Under 35 U.S.C. §103(a)

Claims 1-2, 4, 7-10 and 17-21 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Kemmer *et al.* (US 4,234,831) in view of Spinner *et al.* (US 5,771,174) and Mizutani (US 5,532,533). Withdrawal of this rejection is respectfully requested for at least the following reason.

i. Kemmer et al., Spinner et al. and Mizutani, alone or in combination, fail to teach or suggest all the limitations set forth in independent claims 1 and 17 and associated dependent claims.

> To reject claims in an application under §103, an examiner must establish a *prima facie* case of obviousness. A *prima facie* case of obviousness is established by a showing of three basic criteria. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) ***must teach or suggest all the claim limitations***. *See* MPEP §706.02(j). The ***teaching or suggestion to make the claimed combination*** and the reasonable expectation of success ***must be found in the prior art and not based on the Applicant's disclosure***. *See In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991) (emphasis added).

Independent claims 1 and 17 recite similar claim limitations, namely, ***a control system integrated with the amplifier, the control system having a network interface*** *operative to receive control information, the control system being operative to control the amplifier to selectively energize the coils to effect desired movement of the plunger based on the control information received via the network interface,* ***wherein the control system and an associated rotary-linear motor are integrated into a single module***. It is apparent that the invention as claimed comprises ***a control system*** that is ***integrated with an amplifier***; the control system together with the integrated amplifier further includes ***a network interface*** operative to receive control information. The control system further controls the amplifier, which is integrated with the control system, to selectively energize coils to effectuate movement in a plunger based on control information received *via* the network interface. The ***control system having a network interface*** and the ***integrated amplifier*** is further ***integrated with a rotary-linear motor*** to form ***a single module***. Kemmer *et al.*, Spinner *et al.* and Mizutani, either alone or in combination, fail to recite these novel features of the claimed invention.

In the Final Office Action dated April 15, 2004, the Examiner concedes that Kemmer *et al.* is silent regarding both a network interface operative to receive control information, and a control system that is integrated with a rotary-linear motor to form a single unit. Further, as was stated in applicants' representative's response to the Final Office Action dated April 15, 2004, and is reiterated herein, Kemmer *et al.* also fails to teach or suggest ***a control system*** that is ***integrated together with the rotary-linear motor*** to form ***a single indivisible unit*** that includes not only ***an amplifier*** to selectively energize the coils, but also includes ***a network interface*** operative to receive control information.

The Examiner in order to cure the deficiencies of Kemmer *et al.* provides Spinner *et al.* to rectify, in particular, Kemmer *et al.*'s lack of teaching or suggestion of a network interface operative to receive control information. The Examiner asserts that support for this contention may be found within Figures 1 and 2, col. 2, lines 49-52 and col. 4, lines 23-30 of Spinner *et al.* Perusal of the cited passages however indicates that the network interface disclosed in Spinner *et al.* is not in any way contained within the control system as recited in the subject claims, but rather it appears that the network interface – gateway

– as provided by Spinner *et al.* is a distinct and separate entity from the integrated control system and rotary-linear unit. In fact, Spinner *et al.* illustrates the fact that the network interface is a distinct entity from both the control system and the rotary linear unit in Figure 1, wherein the network interface – gateway – is illustrated as being distinct from both the actuators as well as the control system. In addition, careful scrutiny of Figure 1 illustrates that there exists merely one network interface for a plurality of actuators, and similarly only one control system for the same plurality of actuators. This is in stark contrast to the claimed invention wherein each integrated control system and rotary-linear unit has both a network interface as well as a control system integrated therein. Moreover, according to The American Heritage College Dictionary (3rd ed 1993), *having* has the following connotation: "**having** *v.* **had, having, has** – *tr.* **1.c.** To possess or contain as a *constituent* part." *Id.* at 622 (emphasis added). Further, in the Response to Arguments section of the Final Office Action dated April 15, 2004, the Examiner states: "Applicant argues that Spinner's network interface is not 'integrally affixed' to the control system; however, the examiner notes that this language is not in the claims. Rather, the broad and somewhat vague term 'integrated' is used, i.e., 'the control system and an associated rotary-linear motor are integrated into a single module.'" *Id.* at page 16. Applicants' representative avers to the contrary. According to The American Heritage College Dictionary (3rd ed 1993), the verb *integrated* has the following specific meaning "**integrate** *v.* **–grated, -grating, -grates.** – *tr.* **1.** To make a whole by bringing all parts together; unify." *Id.* at 706. In addition, the Concise Oxford English Dictionary (Revised 10th ed 2002) provides a similar definition, namely: "**integrate** v. **1.** combine or be combined to form a whole." *Id.* at 735. Thus, contrary to the Examiner's assertion, it is clear that the network interface as recited in the subject claims forms a constituent part of the integrated control and rotary-linear unit, and that Spinner *et al.* fails to teach or suggest this particular novel feature of the claimed invention.

The Examiner, in recognition that both Kemmer *et al.* and Spinner *et al.* are silent regarding all the limitations set forth in the subject claims, and in particular, that both Kemmer *et al.* and Spinner *et al.* fail to teach or suggest a control system integrated with a rotary-linear motor, attempts to utilize Mizutani as substantiation. While Mizutani provides a control apparatus integrated with a servo motor, Applicants' representative

contends that since Kemmer *et al.*, and Spinner *et al.* fail to teach or suggest a network interface that forms a constituent part of the integrated control and rotary-linear unit, and because Mizutani is silent regarding this salient feature, that neither Kemmer *et al.*, Spinner *et al.* nor Mizutani, individually or in combination, teach or suggest each and every limitation set forth in the subject claims. Accordingly, reversal of this rejection with respect to independent claims 1 and 17, and claims depending there from, is respectfully requested.

B. Rejection of Claims 11-15 Under 35 U.S.C. §103(a)

Claims 11-15 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Sudo *et al.* (US 4,644,205) in view of Spinner *et al.* (US 5,771,174) and Mizutani (US 5,532,533). This rejection should be withdrawn for at least the following reason.

i. Sudo et al., Spinner et al. and Mizutani, alone or in combination, fail to teach or suggest each and every limitation set forth in independent claim 11 as claims that depend there from.

Independent claim 11 recites ***an integrated control system having a network interface operative to receive control information via an associated network****, the control system being operative to selectively energize the first and second sets of coils to effect movement of the plunger in at least one of the linear and rotational modes, wherein* ***the integrated control system and an associated rotary-linear motor are integrated into a single module***. As has been discussed *supra*, the invention as claimed integrates, *inter alia*, a network interface operative to receive control information from an associated network. In particular, it is the control system that has a network interface, and it is the control system with the network interface that is further integrated with a rotary-linear motor to form a single module. Sudo *et al.*, Spinner *et al.* and Mizutani fail to teach or suggest this exemplary feature of the claimed invention.

The Examiner concedes in the Final Office Action dated April 15, 2004, that Sudo *et al.* is deficient in this respect, *e.g.* fails to provide a network interface operative to receive control information *via* an associated network, and is silent regarding the integration of the control system and the rotary-linear motor into a single unitary module.

Thus, to cure the deficiencies rendered by Sudo *et al.*, the Examiner cites Spinner *et al.* and Mizutani. However, as has been stated with respect to independent claims 1 and 17 *supra*, both Spinner *et al.* and Mizutani fail to teach or suggest ***a control system having a network interface*** as is recited in the subject claim. Accordingly, since none of the cited documents teach or suggest all the limitations recited in independent claim 11, withdrawal of this rejection and allowance of claims 11-15 is respectfully requested.

C. Rejection of Claims 1-10 and 16-21 Under 35 U.S.C. §103(a)

Claims 1-10 and 16-21 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Sudo *et al.* (US 4,644,205) in view of Spinner *et al.* (US 5,771,174), Gerard (US 4,751,437) and Mizutani (US 5,532,533). Reversal of this rejection is respectfully requested for at least the following reasons.

i. Sudo et al., Spinner et al., Gerard and Mizutani, alone or in combination, fail to teach or suggest each and every limitation set forth in independent claims 1, 16 and 17 and associated dependent claims.

As has been stated above, Sudo *et al.*, Spinner *et al.* and Mizutani fail to teach or suggest a control system that has as one of its constituent parts, a network interface; the control system so constituted in turn being integrated with the associated rotary-linear motor to form a single unit. Further, Gerard is silent regarding this feature. Accordingly, since none of the documents cited teach or suggest a control system having a network interface, this rejection should be withdrawn with respect to independent claims 1, 16 and 17 and claims that depend there from.

D. Rejection of Claims 1-4, 7-10 and 16-21 Under 35 U.S.C. §103(a)

Claims 1-4, 7-10 and 16-21 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Kemmer *et al.* (US 4,234,831) in view of Lee (US 4,692,678) and Mizutani (US 5,532,533). This rejection should be withdrawn for at least the following reasons.

i. Kemmer et al., Lee and Mizutani, either alone or in combination, fail to teach or suggest all the limitations set forth in independent claims 1, 16 and 17 and associated dependent claims.

As stated above in relation to Kemmer *et al.* and Mizutani, both documents fail to teach or suggest a control system that has a network interface as a constituent component of the control system, wherein the control system that contains the constituent network interface component is further integrated together with a rotary-linear motor to form a single module. The Examiner contends in the Final Office Action dated April 15, 2004, that Lee provides a network interface that forms a constituent component of the control system at col. 5, lines 14-25. However, as applicants' representative noted in the Reply to Final Office Action dated April 15, 2004, Lee provides a closed loop control system that is separate and distinct from the servo-motor itself. Lee is silent regarding a control system that has a *network* interface. As is evident Lee fails to elucidate the control system recited in the subject claims, *viz.* a control system having a network interface as a constituent component, the control system so constituted being integrated with an amplifier, the control system containing the network interface and amplifier being further integrated with a rotary-linear motor to form a single module. Thus, since all the documents cited by the Examiner are deficient in teaching or suggesting the substance of applicants' claims, i.e. independent claims 1, 16 and 17 and associated dependent claims, it is respectfully requested that this rejection be withdrawn and the subject claims be placed in condition for allowance.

E. <u>Rejection of Claims 11-15 Under 35 U.S.C. §103(a)</u>

Claims 11-15 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Sudo *et al.* (US 4,644,205) in view of Lee (US 4,692,678) and Mizutani (US 5,532,533). This rejection should be reversed for at least the following reasons.

i. Sudo et al., Lee and Mizutani, alone or in combination, fail to teach or suggest each and every limitation set forth in independent claim 11 and associated dependent claims.

As has been discussed *supra*, the Examiner acknowledges in the Final Office

Action dated April 15, 2004, that Sudo *et al.* does not teach or suggest a control system having as one of its constituent components a network interface. Consequently, the Examiner attempts to rely upon the teachings of Lee and Mizutani to cure the deficiencies presented by Sudo *et al.* However, as has been argued in relation to the teachings of both Lee and Mizutani, both documents are silent regarding a ***control system having a network interface***. Accordingly, since all three references cited by the Examiner are silent regarding this particular salient feature recited in independent claim 11 and its associated dependent claims, withdrawal of this rejection and allowance of independent claim 11 and associated dependent claims is respectfully requested.

F. Rejection of Claims 22-27 Under 35 U.S.C. §103(a)

Claims 22-27 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Sudo *et al.* (US 4,644,205) in view of Horikoshi *et al.* (US 5,142,172), Gerard (US 4,751,437) and Spinner *et al.* (US 5,771,174). Withdrawal of this rejection is respectfully requested for at least the following reasons.

i. ***Sudo et al., Horikoshi et al., Gerard and Spinner et al., either individually or in combination, fail to teach or suggest all the limitations set forth in independent claim 22 and associated dependent claims.***

Independent claim 22 recites ***a control system and a network interface integrated into a single module, the control system integrated with a rotary-linear actuator,*** *the network interface receiving and transmitting at least one of control and diagnostic information to an associated network.* As is apparent the claimed invention provides a control system that has a network interface that is integrated to form a single module. The control system with the integrated network interface is then further integrated with a rotary-linear actuator. Sudo *et al.*, Horikoshi *et al.*, Gerard and Spinner *et al.*, either alone or in combination, fail to teach or suggest this novel aspect of the claimed invention.

As the Examiner concedes in the Final Office Action dated April 15, 2004, Sudo *et al.* fails to disclose a control system and a network interface that is integrated into a

single module. In order to cure the deficiency rendered by Sudo *et al.* the Examiner cites Spinner *et al.* to suggest a control system that includes a network interface that is integrated into the control system. However, as has been posited throughout this appeal brief, Spinner *et al.* does not teach or suggest a control system that has a network interface integrated thereon. Thus, the combination of Sudo *et al.*, Horikoshi *et al.*, Gerard and Spinner *et al.*, contrary to the Examiner's assertions, does not teach or suggest all the limitations set forth in the subject claims. Accordingly, in view of at least the foregoing, it is respectfully requested that independent claim 22, and claims that depend there from, should be placed in condition for allowance, and that this rejection be withdrawn.

G. **Conclusion**

For at least the above reasons, the claims currently under consideration are believed to be patentable over the cited references. Accordingly, it is respectfully requested that the rejections of claims 1-4 and 6-27 be reversed.

If any additional fees are due in connection with this document, the Commissioner is authorized to charge those fees to Deposit Account No. 50-1063.

Respectfully submitted,
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VIII. Claims Appendix (37 C.F.R. §41.37(c)(1)(viii))

1. An integrated rotary-linear actuator system, comprising:

a plunger movable along and rotatable about a longitudinal axis extending through the plunger, wherein the plunger is supported against a motor support via bearings;

a coil system having two sets of coils arranged to, when energized, interact with the plunger, the first set of coils being operative to provide an electric field to effect movement of the plunger in a linear mode, the second set of coils being operative to effect movement of the plunger in a rotational mode;

an amplifier coupled to the coils and operative to provide electrical energy to energize the coils; and

a control system integrated with the amplifier, the control system having a network interface operative to receive control information, the control system being operative to control the amplifier to selectively energize the coils to effect desired movement of the plunger based on the control information received via the network interface,

wherein the control system and an associated rotary-linear motor are integrated into a single module.

2. The system of claim 1, further comprising an array of magnets arranged on one of an outside surface of the plunger and an inside surface of the motor support, which supports the plunger to permit movement thereof.

3. The system of claim 2, wherein the first set of coils are arranged to apply an axial force on the array of magnets to drive the plunger in the linear mode and ~~a~~ the second set of coils arranged to apply a tangential force on the array of magnets to drive the plunger in the rotational mode.

4. The system of claim 2, wherein the motor support comprises a bearing support and a housing that define a well operative to receive the plunger, the plunger

being supported by a bearing located between the plunger and the bearing support, such that the plunger is axially movable along the longitudinal axis between a retracted position and an extended position and rotatable about the longitudinal axis.

5. (Canceled)

6. The system of claim 1, wherein the amplifier further comprises first and second amplifiers, each being operative to provide electrical energy to a respective one of the first and second coils.

7. The system of claim 1 in combination with a network to which the network interface is coupled, the combination further comprising a computer operative to communicate the control information to the control system *via* the network interface using a network protocol.

8. The combination of claim 7, wherein the control information includes program data to program operating characteristics of at least part of the integrated rotary-linear actuator system.

9. The combination of claim 7, wherein the integrated rotary-linear actuator system further comprises at least one sensor operative to sense a condition of the integrated rotary-linear actuator system and provide a sensor signal indicative thereof, the control system being operative to communicate condition data based on the sensor signal to the computer via the network interface using the network protocol.

10. The combination of claim 9, wherein the control information includes program data operative to program operating characteristics of at least part of the integrated rotary-linear actuator system based on evaluation of the condition data from the integrated rotary-linear actuator system.

11. A rotary-linear actuator system, comprising:

a motor support having a well;

a plunger supported for movement via bearings in at least part of the well so as to enable axial movement of the plunger relative to the well along a longitudinal axis of the plunger and rotational movement of the plunger about the longitudinal axis;

an array of permanent magnets associated with the plunger, wherein half of the magnets are oriented such that their north poles point radially outward and the other half such that their north poles point radially inward;

a first set of coils arranged to, when energized, apply an electric field that interacts with the array of magnets and provides an axial force to drive the plunger element in a linear mode;

a second set of coils arranged to, when energized, apply an electric field that interacts with the array of magnets and provides a tangential force to drive the plunger element in a rotational mode; and

an integrated control system having a network interface operative to receive control information via an associated network, the control system being operative to selectively energize the first and second sets of coils to effect movement of the plunger in at least one of the linear and rotational modes,

wherein the integrated control system and an associated rotary-linear motor are integrated into a single module.

12. The system of claim 11, further comprising a computer operative to communicate the control information to the control system via the associated network using a network protocol.

13. The system of claim 12, wherein the control information includes program data having executable instructions to program the control system to effect desired operating characteristics of the rotary-linear actuator system.

14. The system of claim 12, wherein the rotary-linear actuator system further comprises at least one sensor operative to sense a condition of the rotary-linear actuator system and provide a sensor signal indicative thereof, the control system being operative

to communicate condition data based on the sensor signal to the computer via the associated network using the network protocol.

15. The system of claim 14, wherein the control information includes program data to program operating characteristics of at least part of the integrated rotary-linear actuator system based on evaluation of the condition data from the integrated rotary-linear actuator system.

16. An integrated rotary-linear actuator system, comprising:

means for supporting a plurality of motors including means for supporting a bearing, the means for supporting the plurality of motors and the means for supporting the bearing defining a well;

means for moving a stage and adapted to be received by the well, the means for moving the stage being axially movable along its longitudinal axis between retracted and extended conditions and rotatable about its longitudinal axis, the means for moving the stage being supported by a bearing located between the means for moving the stage and the means for supporting the bearing;

means for providing a magnetic field arranged on the means for moving the stage;

means for applying a substantially axial force on the means for providing the magnetic field and driving the means for moving the stage linearly;

means for applying a substantially tangential force on the means for providing the magnetic field for the means for moving the stage rotationally;

means for amplifying an electrical signal and providing the amplified signal to at least one of the means for applying; and

control means for controlling the means for amplifying, the control means including means for interfacing with an associated network and receiving control information to program the control means to control the means for amplifying to selectively activate the means for applying, and transmitting diagnostic information to at least one computer associated with the network,

wherein the control means and an associated motor are integrated into a single module.

17. A method for controlling an integrated rotary-linear actuator system, the rotary-linear actuator system including a control system and an associated rotary-linear motor integrated into one module, the control system including a network interface to enable communication over an associated network, the method comprising:

receiving control information at the network interface of the integrated rotary-linear actuator system *via* the associated network;

programming operating parameters of the rotary-linear actuator system based on the received control information; and

controlling an amplifier to selectively energize two sets of coils of the rotary-linear actuator system according to the programmed operating parameters, such that a plunger, which is moveable linearly and rotationally about a longitudinal axis thereof, moves in at least one of a linear and rotational direction, the linear direction in response to the energization of a first set of coils, and the rotational direction in response to the energization of a second set of coils.

18. The method of claim 17, wherein the control information is communicated from a remote computer *via* the network interface using a network protocol.

19. The method of claim 17, wherein the control information includes program data, the operating parameters of the rotary-linear actuator system being programmed based on the program data.

20. The method of claim 18, further comprising:

sensing at least one condition of the integrated rotary-linear actuator system;

providing a sensor signal indicative of the sensed at least one condition; and

sending condition data from the integrated rotary-linear actuator system to the computer via the network interface using the network protocol, the condition data being based on the sensor signal.

21. The method of claim 20, wherein the control information includes program data to program the operating parameters of at least part of the integrated rotary-linear actuator system based on evaluation of the condition data sent from the integrated rotary-linear actuator system.

22. An integrated rotary-linear actuator system, comprising:

a plunger movable along and rotatable about a longitudinal axis extending through the plunger, wherein the plunger includes an inner and an outer cylindrical portion, both open at one end, with permanent magnets attached to the inner walls of the inner and outer cylindrical portions;

air bearings supporting the plunger against an actuator support stage;

a coil system having coils arranged to, when energized, interact with the magnets attached to the plunger to move the plunger in a rotational mode and/or a linear mode;

an amplifier coupled to the coils to provide electric energy to the coils;

a control system and a network interface integrated into a single module, the control system integrated with a rotary-linear actuator, the network interface receiving and transmitting at least one of control and diagnostic information to an associated network.

23. The system of claim 22 further comprising an encoder system for determining the position of the plunger integrated into a single module with the actuator.

24. The system of claim 22, further comprising a computer to communicate control information to the control system via the associated network.

25. The system of claim 24, wherein the computer retrieves diagnostic information related to the health of the actuator via the associated network.

26. The system of claim 24, wherein the computer is connected to a remote computer over the Internet.

27. The system of claim 26, wherein the remote computer is operable to send calibration and/or maintenance program data to the actuator system.

IX. Evidence Appendix (37 C.F.R. §41.37(c)(1)(ix))

None.

X. Related Proceedings Appendix (37 C.F.R. §41.37(c)(1)(x))

None.